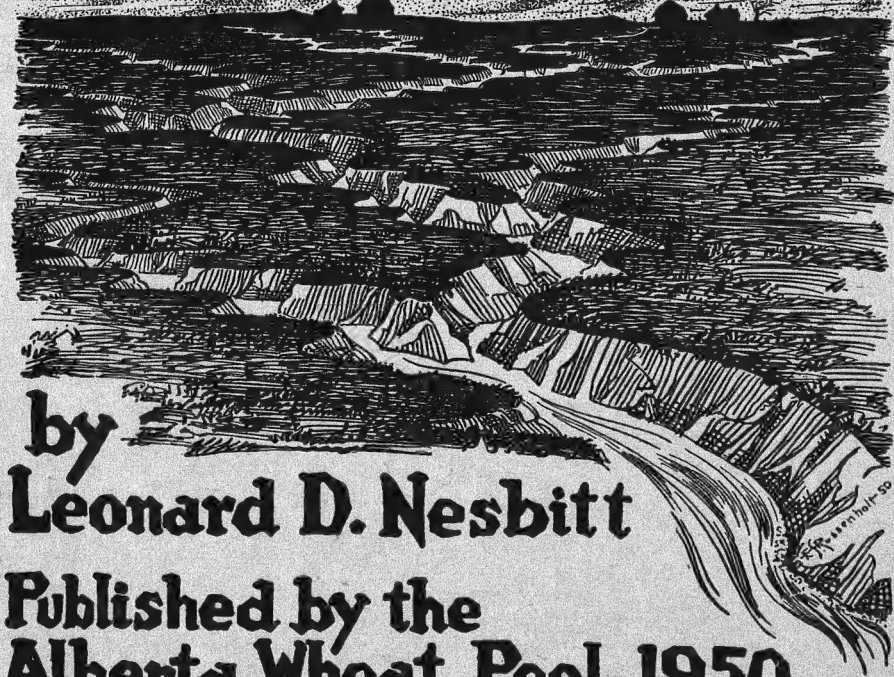


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Save Our Soil



by
Leonard D. Nesbitt

**Published by the
Alberta Wheat Pool, 1950**

SAVE OUR SOIL

"A nation rises and develops in proportion to the fertility of the land. With the exhaustion of the land, culture and morals disappear."

—Baron Justice Von Liebig.

SAVE OUR SOIL

By
LEONARD D. NESBITT

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Published by
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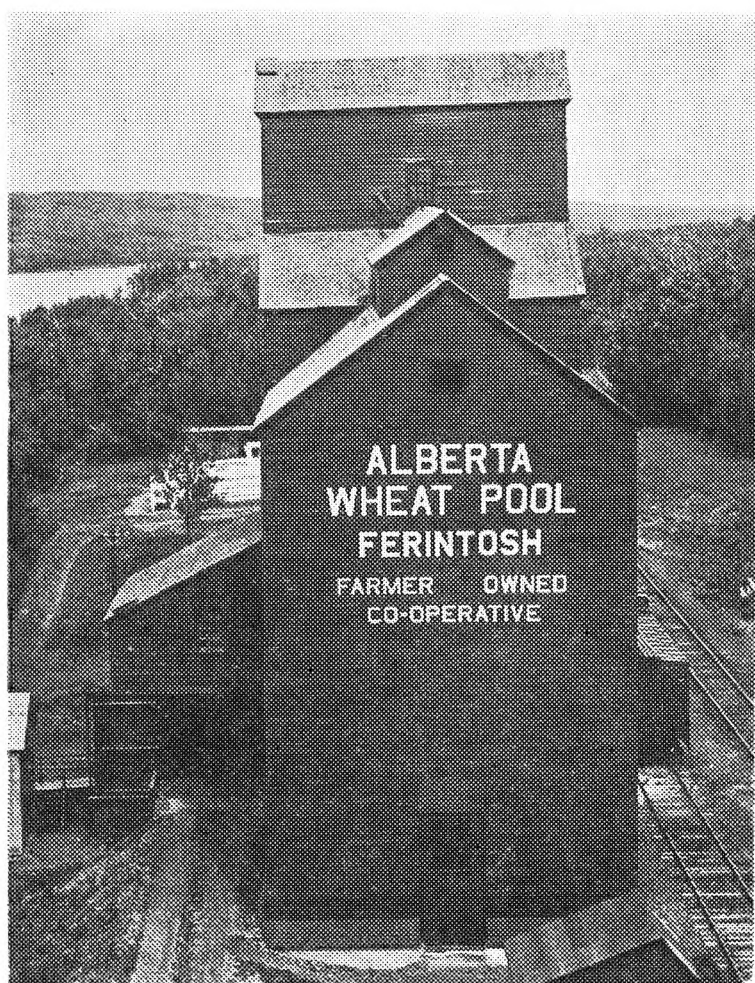
GRASS - - - John J. Ingalls

Lying in the sunshine among the buttercups and dandelions of May, scarcely higher in intelligence than the minute tenants of that mimic wilderness, our earliest recollections are of grass; and when the fitful fever is ended and the foolish wrangle of the market and forum is closed, grass heals over the scar which our descent into the bosom of the earth has made, and the carpet of the infant becomes the blanket of the dead. Grass is the forgiveness of Nature — her constant benediction. Fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Streets abandoned by traffic become grassgrown like rural lanes and are obliterated. Forests decay, harvests perish, flowers vanish, but grass is immortal. Beleaguered by the sullen hosts of Winter, it withdraws into the impregnable fortress of its subterranean vitality and emerges upon the first solicitation of Spring. Sown by the winds, by wandering birds, propagated by the subtle agriculture of the elements which are its ministers and servants, it softens the outline of the world. It bears no blazonry of bloom to charm the sense with fragrance or splendor, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, and yet, should its harvest fail for a single year, famine would depopulate the world.

SAVE OUR SOIL

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ONE OF 486.

INTRODUCTION

THIS booklet is published by the Alberta Wheat Pool as a contribution to the campaign for soil conservation. Agriculture is Alberta's basic industry and will continue to be so for generations to come. Conservation of the soil and of its fertility must be the concern of not only the farmers, but of all the people of the province. The erosion of fertile farm land by wind and water must be checked so that the land may be preserved for future generations.

Agriculture here was in its infancy when Alberta was made a Canadian province in 1905. In 1906 the total acreage under field crops in this province was only 660,000. At present around 13,000,000 acres are annually seeded to such crops.

The first indication of the danger of widespread wind erosion occurred in Southern Alberta in the spring of 1920 when a series of wind storms filled roadsides and covered fences with rich topsoil. In June of that year 75,000 acres of grain blew out in the area now known as the Lethbridge Northern Irrigation district.

Windy springs have occurred at intervals in succeeding years. The weekly news letter of the Lethbridge Experimental Station of May 16, 1945, said: "The storm of May 10th was without question the most devastating we have had in ten years and thousands of acres of crop land were severely affected. Why has this happened? Simply because we are careless . . . It is all well and good to go to war to save Canada for democracy, but why then let our part of Canada blow away?"

In the pamphlet "Cropping for Profit and Permanency", by W. E. Bowser, Dominion Experimental Farms, and A. G. McCalla, University of Alberta, the following statement is made:

"Permanency can be assured only if the soil is kept in good physical condition and the fertility is not allowed to become depleted. A soil depleted of its fibre, with a consequent loss of good granular structure will generally drift easily since fibre, even when well decomposed, tends to join the soil particles together. Soils rich in fibre are also generally much more resistant to water and wind erosion. Unless a farmer can afford to keep from one-quarter to one-third of his land seeded down to grass (or if possible a grass and legume mixture) his farm is not likely to produce satisfactorily over a long period of years."

CHAPTER 1.

CONTROL METHODS

WIND EROSION

"Strip farm" fields with strips not over 20 rods wide.

Practise plowless tillage on fallows, with careful attention to the selection and use of tillage implements so that all stubble and other plant residue is anchored on the surface as a trash cover.

In the late summer, if there is not sufficient trash to protect the soil through the fall, winter and spring, seed to cover crops, or "list". Bare, dusty fallows should never be subjected to the drifting hazards of the fall, winter and spring seasons.

The "listing" process consists in cutting ridges several feet apart.

Sandy soils in dry areas, or other lands that are extremely difficult to control, should be seeded permanently to grass.

Substitute rotations for fallows wherever feasible and where moisture conditions permit.

The following methods may be used in cases of emergency:

1. Scattering straw or manure.
2. Ridging with lister or with the duckfoot cultivator.
3. Plowing furrows about one rod apart at right angles to the direction of the prevailing winds.
4. Listing with a disc lister during winter months when the frozen soil becomes bare.

New machinery purchases should be selected to meet the needs of soil drifting control. The duckfoot cultivator, listing shovel attachments, rod weeder, and the one-way disc are such implements. Keep speeds under four miles per hour. Blade weeders and other machines especially adapted to control drifting in certain areas have been devised. Where proven practical their use is recommended.

Never use implements which pulverize the soil.

Crop rotations which include grass and intertilled crops may be used to advantage in regions receiving sufficient precipitation.

Planting of shelterbelts aids in preventing soil drifting. The prevailing winds in Alberta are from the west, so shelterbelts should be planted on the western side of the farm.

WATER EROSION

There are four fundamental methods of preventing water erosion:

1. Keeping the soil covered with crops or plant residue such as stubble, thereby reducing the amount of water which becomes "run-off", and increasing the amount which percolates in the soil.
2. Preventing water from developing into streams. This can be done by contour farming of fields and contour dyking; also by storing flood waters in ponds.

3. Seeding down drainageways to grass. It may be necessary to keep excessively steep lands in grass. Every effort should be made to preserve trash covers on any fallows located on sloping fields.

4. Controlling the flow of water in runways, ravines and streams which carry surplus "run-off". The faster water runs away, the more good soil it steals. By reducing the speed of running water by one-half we can reduce by 98 per cent its capacity to carry soil.

CHAPTER 2.

SOIL, THE SOURCE OF LIFE

Soil is a combination of mineral particles mixed with organic matter. It is swarming with living organisms from bacteria to badgers. This complex mixture of animal, vegetable and mineral matter, along with sunlight, air and water, nourishes all plant life and supports all animal life, including mankind.

Soil fertility is not a condition, but a process. It is a ceaseless activity in which dead organic matter is disintegrated by tiny organisms and combined with disintegrating mineral matter to form plant food.

The conservation of the soil and the preservation of its fertility is of the greatest importance, not only to farmers but to the people living in villages, towns and cities. Good fertile soil is a heritage that should be handed down undamaged from one generation to another.

Soil erosion has been called a creeping death. It is fatal not only to the growth of plants, but to the development of man. It took Nature upwards of 500 years to build an inch of prairie soil which may be swept away in a single severe wind storm.

Because of the limitation of good agricultural land throughout the world, enlightened nations are becoming more impressed with the need of soil conservation. Wind and water erosion have taken an enormous toll of farm lands in many countries.

In many parts of the world mankind's treatment of the soil has been a record of ignorance and destruction. Fields have been wasted, grasslands shorn bare, forests have been despoiled of their capacity for sustained yield, and wind and water erosion have wrought incalculable destruction.

Herodotus, father of history, in his story of the human race in the valley of the Euphrates (Mesopotamia), tells of a prosperous agriculture supporting a populous region in ancient times. That land was supposed to be the location of the Garden of Eden, and certainly in prehistoric times it was the garden of the world.

It supported great cities like Babylon and Nineveh. But the soil was neglected, its fertility impaired, irrigation canals silted up, agriculture fell into decay, and so did civilization. Deserts mark the sites where great cities once stood.

At the time of Christ, Palestine had a population of three million people. The ravages of wars, together with the neglect and abuse of the land and the cutting down of forests, reduced the population to below 200,000 in 1850. Walter Lowdermilk, the American soil conservationist, calculates that with the restoration of the soil of Palestine that little country could support a population of close to six million people.

Soil erosion and forest destruction have wrought immense damage to great farming areas of China. The Sahara desert has spread over North Africa, the granary of ancient Rome. Elsewhere throughout the world the wasted condition of once fertile lands tells the story of ruthless exploitation.

In the United States alone there are 450 million acres of crop land, of which 306 million is intertilled. Dr. H. H. Bennett, chief of the United States soil conservation service, said one-fifth of the original area of tillable land in that country has been ruined by erosion and bad farming practices; one-third of the land still in use has been badly damaged; and another third is on the ragged edge.

Canada, too, is suffering serious losses through soil erosion, but, unlike the United States, this nation has not developed a soil conservation service. The duties of such a service would be to survey the situation and draw up plans calculated to minimize erosion damage; also to launch a program for soil protection which will interest farmers and gain their co-operation.

CHAPTER 3.

THE DANGER IN WESTERN CANADA

The outstanding characteristic of agriculture in the prairie provinces of Western Canada is the predominance of cereal culture. Annually in this region about 44 million acres of land are seeded to field crops, of which about 40 million acres are under the cereal crops — wheat, oats and barley. The production of cereal crops has been imposed on prairie agriculture by the climate which limits plant growth to relatively drouth resistant grains and grasses. One striking feature of agriculture on the Canadian prairies is the large percentage of land which is under summer-fallow each year — around 20 million acres. This great expanse of bare land is an invitation to wind erosion.

Soil drifting is a direct result of the practice of straight grain growing. The late Dr. F. A. Wyatt, former professor of soils at the University of Alberta, said that soil drifting will be-

come more serious on the high windy plains of the prairie provinces unless the farmer can be made to realize that he must take the necessary precautions to prevent its development.

Dr. Wyatt pointed out that soil drifting occurs from Texas to the Peace River country and from the Rocky Mountains to Manitoba. It rarely approaches a serious condition in districts of high rainfall. The worst damage is done when strong winds pass over dry soil which is in a fine state of cultivation.

Some years ago Dr. Wyatt stated that the loss of one inch of soil from one acre of land in the black soils belt of Alberta means the removal of 300 pounds of phosphorus, 1,500 pounds of nitrogen and 15 tons of organic matter.

Phosphorus thus lost would be equal to the amount removed from the soil by 20 crops of wheat, each yielding 50 bushels to the acre. To replace with commercial fertilizers the loss of phosphorus and nitrogen from the removal of one inch of topsoil would cost at current prices (1950) around \$150 an acre. It would require 150 tons of farm manure to replace the lost nitrogen alone.

The above figures are for the most fertile soils in Alberta, but 40 per cent of these figures would represent conditions in any of the less fertile areas of the province.



Photo — Canadian Dept. of Agriculture

DANGER AHEAD

*This is the extreme example of the final results of soil drifting
— desolation and abandonment of farm lands.*

THE CREEPING DESERT

W. S. Chepil of the Dominion Experimental Station, Swift Current, Saskatchewan, writing on October 4, 1943, on the effect of wind erosion of prairie soils, said wind erosion is a sorting process causing fine materials such as silt and clay to be steadily removed from the coarser fractions. This causes soils to be sandier than they were originally. The greatest change has taken place on the original sandy soils, which once produced good crops but have since been changed to virtual sand dunes. The originally good sandy loams have, within the past 50 years or less of cultivation, lost from 15 to 50 per cent of their silt and clay content and the sand content has been increased proportionately. He said: "Provided we continue to exploit these lands for wheat production as in the past, and provided the change in texture continues at the same rate as during the last decade or so, these soils will change to virtual sand dunes within the next 50 to 150 years. Within the next 150 years at the same rate of exploitation, Saskatchewan alone will have a sandy waste covering an area of at least 6,000 square miles unless these soils are taken out of cultivation and sown to grass."

Mr. Chepil said that much has been learned on how to control soil drifting, but complete control cannot be accomplished so long as wheat continues to be the principal agricultural product.

CHAPTER 4.

FERTILITY DECLINES

The virgin prairie soil in Western Canada was quite fertile. Year after year for untold centuries the grass grew, decayed and was absorbed into the soil, steadily increasing the organic material therein. The nitrogen content of the soil is dependent upon the amount of organic matter present. This organic matter, or humus, provides a sponginess to the soil which holds moisture and encourages bacterial action. When you have grass roots growing in the soil, feeding it with air, and then when you have it mixed with legumes drawing nitrogen into the soil from above and helping pump up from deeper levels the fertility which exists there, then you have under way a real program for increasing soil fertility.

Continuous cropping uses up soil fertility. A study by the University of Alberta and the Dominion Experimental Farm Service, published in 1945, showed that on the average crops grown in brown, dark brown, black and grey soil zones, absorbed from one-third to one-half of the nitrogen from the top six inches of cultivated soil after an average period of cultivation of just over 22 years. In that period of time the average losses per acre of organic matter from the different soil zones to a depth of 12 inches were as follows: brown 25,566 pounds, dark brown 32,289, black 62,935, black transition 92,115, grey transition 39,632, and grey 29,253.

At Crystal City, Manitoba, on deep medium loam soil where the organic content of virgin prairie is approximately 13 per cent, land that had grown grain exclusively for nearly 70 years contained 3 per cent humus. The same land, when seeded to brome grass and left down for four years had an organic content of 5 per cent.

On medium heavy clay land at Goodlands, Manitoba, virgin prairie averaged 8 per cent organic content. Old grain land that had been subject to wind erosion had 2 per cent. The same soil, after lying in brome for four years, had 4 per cent.

At Lyleton, Manitoba, on light, fine loam, virgin prairie tested 6 per cent organic matter. Land used exclusively for grain for 40 years and eroded by wind, contained 3 per cent. This same land seeded to crested wheat grass for seven years was raised to 4 per cent organic content.

D. A. Brown, of the Dominion Experimental Farm, Brandon, Manitoba, wrote in October 1947, that half a century or more of grain-fallow management has seriously depleted the organic content of soils in southwestern Manitoba. He said that though regrassing helps to partially restore fertility, it has to be done at regular intervals to maintain even a low organic content.

Dr. E. S. Archibald, director of the Dominion Experimental Farm Service, Ottawa, says yields of wheat have been steadily decreasing in the prairie provinces. In 30 years the decline has been nearly 7 bushels to the acre at Lethbridge and 6 bushels at Lacombe.

Only an intensive survey extending over a period of years can accurately measure the decline in the fertility of Western Canadian farm lands. In the drouth areas much of the original fertility remains as is evidenced by the heavy production in wet years. Constant grain cropping in the areas of better rainfall, however, extracts a steady toll of fertility from the land.

Professor C. F. Bentley, of the soils department, University of Alberta, calculates that the wheat crops of the west from 1938 to 1942 inclusive extracted 190,000 tons of phosphate alone from the soil.

While Canadians may take pride in the huge quantities of grain exported overseas from Western Canada over past decades, the fact remains that this process has also resulted in the exportation of a substantial percentage of the fertility of Western Canadian soil.

An effort to estimate what our wheat exports are doing to our soil fertility was made at the United Nations scientific conference in 1949 at Lake Success on Conservation and Utilization of Resources. Dr. P. O. Ripley of the Dominion Department of Agriculture, told the conference that in 1944 Canada exported 291,000,000 bushels of wheat, 40,000,000 bushels of barley and 83,000,000 bushels of oats. These exports represent 219,126 tons of nitrogen, 94,234 tons of phosphorus and 47,341 tons of potash besides the trace minerals from the soil needed to produce

the grain. Dr. Ripley estimated that most of the wheat and coarse grains came from 160,000 farms, so that more than two tons of fertility per farm was exported. In a 50 year period that means that each farm reduced its virgin fertility by 100 tons.

CHAPTER 5.

GRASS RESTORES HUMUS

The prairie regions were originally covered with a variety of native grasses, the principal one being blue grama. While nutritious, the productivity of these grasses is comparatively light. It has been said that in the natural state it took at least 500 years for prairie vegetation to manufacture one inch of top soil.

The humus content of soil is maintained and increased by the decaying organic matter. This humus content acts as a sponge, absorbing large quantities of water in seasons of plenty and releasing it during the dry periods. It changes the physical condition of the soil making it granular, open and loose, allowing the penetration of water, air and bacteria, all of which make soil more productive.

Nature had a leisurely way of replenishing the soil, but cultivation by mankind wastes much of the reserve plant food by removing more than is returned. Little thought is given to humus until many soils have changed from a granular, open structure, capable of holding plenty of moisture, to fine particles that compact, puddle and bake and prevent air and bacteria from entering deeply because there is no moisture-carrying capacity.

Once prairie land has been broken by the plow it has been found a difficult process to re-establish the native grasses. As the growing of grass is the best method of restoring organic matter to the soil, other varieties were sought to substitute for native grasses in the seeding of cultivated land.

Brome grass was introduced into Canada in 1887 by the Dominion Department of Agriculture, seed being brought from central Europe. It has proven to be a good grass for Western Canada, particularly in those areas favored with a fair amount of rainfall.

Crested wheat grass came from beyond the Volga River in Russia. Dr. L. E. Kirk, formerly with the University of Saskatchewan, has been interested in this grass since 1915. By 1928 he had produced sufficient seed to provide a fair distribution throughout the prairie province. It is now widely grown.

Crested wheat grass does well in the drier areas. It has the faculty of greening up when rains come after a drouth. When cut early it makes an excellent hay with a high protein content. Its root system is the most extensive of any grass grown in the west.

Alfalfa is a leguminous forage crop which produces a hay of high protein content. It does best under irrigation but will also do fairly well in a mixture with brome and crested wheat grass in areas where rainfall is good. Being a legume it restores nitrogen to the soil. The suggested mixture is 3 pounds of brome, 3 pounds of crested wheat and 2 pounds of alfalfa for seeding one acre. This will vary according to climatic conditions.

Under ideal conditions a field of clover or alfalfa makes possible the fixation in one season of about 100 pounds of atmospheric nitrogen per acre. This is equivalent to the nitrogen contained in 500 pounds of a 20 per cent nitrogen fertilizer. Most atmospheric nitrogen is made available by the activities of nitrogen-fixing bacteria growing on the nodules of the roots. Part of this nitrogen is used for the manufacture of protein-rich feed, and part is left in the soil. This information was obtained by the Dominion Experimental Station at Smithers, B.C. The conclusion is that legumes are important in maintaining soil fertility. For the seven year period 1942 to 1948 the yields of oats grown continuously on the same ground at the Smithers farm averaged 47.9 bushels an acre. In the same period, oats grown after sweet clover averaged 104.4 bushels, after alfalfa 88.7, after timothy 77.4 and after potatoes 83.6.

There are other grass varieties which do well in certain regions. Information regarding these is available from Dominion and Provincial Departments of Agriculture.

Grass crops, by virtue of their extensive fibrous root systems, provide the best practical means of adding fibre to the soil. An idea of the extent of the root systems of grasses is given by research work of Professor T. K. Pavlychenko, of the University of Saskatchewan. His investigations show that a two-year old crested wheat plant has a root system of 340 miles and a soil penetration of $7\frac{1}{2}$ feet. A two-year old brome grass plant has a root system of 160 miles. Four-year plantings of crested wheat grass produced 8,338 pounds of underground material per acre, and brome grass 5,958 pounds per acre.

CHAPTER 6.

CULTIVATING AGAINST EROSION

The recommended cultural practice for the prevention of soil erosion requires the use of implements which will leave the straw and trash on the surface of the land and will disturb the soil as little as possible. This means the abandonment of the plow for general cultivation in regions susceptible to wind erosion. The plow buries all trash and leaves the land bare and subject to drifting.

The one-way disc when properly handled has saved more soil than any other implement. It should not be used at speeds of over 4 miles an hour. At lower speeds it does not pulverize the soil and it leaves a trash cover on top.



Photo — Alta. Dept. of Agriculture

IMPROPER TILLAGE

This is a farm in the Consort district. The land was plowed and then disced two or three times during the summer. Soil drifting destroyed the crop and the field was a problem throughout the entire summer.

The duckfoot cultivator is an excellent surface work machine. The shovels should be run flat to prevent excessive pulverization of the soil. The implement should not be run at a high speed.

The Lethbridge Experimental Station recommends a "listing" operation in regions where serious drifting is to be expected. This can be done either with a duckfoot cultivator equipped with listing shovels placed 4 to 4½ feet apart, or with the one-way disc with most of the discs removed leaving a disc every 4 feet. With implements so arranged the soil can be trenched and drifting reduced to a minimum. The implements should not be pulled at a speed in excess of 4 miles an hour. The operation is not expensive and the next spring the furrows can be filled in with one stroke of the duckfoot cultivator.

Blade implements which run a few inches under the surface of the soil and disturb it as little as possible do an effective job in many parts of southern Alberta where the land is level, free from stones and comparatively light in texture.

G. E. DeLong, superintendent of the Dominion Experimental Station at Lacombe, Alberta, says that shallow tillage reduces the cost of summerfallowing by one-half and at the same time more efficiently controls most of the annual weeds. In central Alberta, however, circumstances may occur which make it impossible to follow shallow tillage practices and the plow still has a place in preparing stubble land for a grain crop.

The disc harrow is the soil's worst enemy and one of the poorest weeding implements. The drag harrow is useful for levelling and packing the soil, but it too has a definite pulverizing action. Do not use any implement the operation of which powders the soil.

LAND STRIPPING

The strip method of farming, first put into effect in the Monarch district of southern Alberta in 1918, is regarded as a successful method of controlling soil drifting where that danger exists almost every year. The land is divided into strips 10 to



Photo — Alta. Dept. of Agriculture

PROPER LAND CONSERVATION

Field at Castor one-way disced and rod weeded. Produced a yield of 27 bushels per acre.

20 rods wide, the strips running lengthwise against the prevailing winds, which are usually from the west and southwest.

Most farmers vary cropping practices so that fields of grain and summerfallow alternate. In that way the dangerous practice of exposing large fields of summerfallow to wind action is avoided.

The prevalence of sawfly infestation has created a problem for farmers where narrow strips are used. Sawflies do their worst damage around the outside of the field of wheat. In wheat crops on stripped land the sawflies penetrate the entire planting, thus increasing the damage.

CHAPTER 7.

DANGER IN SUMMERFALLOWING

Summerfallowing is practised in the prairie provinces to accumulate two years' moisture for one crop and to diminish the encroachment of weeds. The area annually summerfallowed in this region runs close to 20 million acres. It has been demonstrated, however, that summerfallowing increases the danger of wind erosion.

Dr. E. S. Archibald, director of Dominion Experimental Farms, speaking at Guelph, Ontario, a few years ago said: "Summerfallowing of land as carried out on the prairies of Western Canada is one of the worst things ever developed by Canadian farmers." In one year soil from 12 million acres was moved by wind sufficient to cut off the crop, chiefly because of lack of organic matter and because of summerfallowing, which gave the wind a sweep at the soil. Costs of that wind drifting that year were estimated at \$140 million.

The Lethbridge Experimental Station has worked out a system of agriculture in which the practice of summerfallowing is greatly restricted. At the Pincher Creek sub-station, out of a total cultivated acreage of 590 acres in 1946 only 92 acres were in fallow and 75 acres of the fallow land were seeded to a cover crop. A cover crop is wheat or oats seeded on fallow land in the late summer or early autumn. The grain grows a few inches in height and prevents blowing during the late fall and winter. The land can be cultivated and seeded in the following spring. At the Pincher Creek sub-station grain crops are rotated with hay crops, mostly brome and alfalfa, and summerfallowing is kept at a minimum.

While such a system works well in regions of good precipitation, in drier areas where soil moisture is a primary consideration results probably would be different. In the drier regions

the main consideration is the preservation of soil moisture. Summerfallow, kept free of weeds, will preserve about one-quarter of the moisture falling as rain or snow, according to Dr. J. L. Doughty of the Soil Research Laboratory, Swift Current, Saskatchewan. Under field conditions the average conservation of moisture on bare summerfallow to a depth of 4 feet has been equal to 4 or 5 inches of water.

NEVER BURN STUBBLE

H. J. Mather, former supervisor of soil conservation for Alberta, said: "Stubble burning clears off the field and makes it easier to cultivate, but every time you fire the stubble you are destroying between \$2 and \$4 worth of plant food per acre. You can replace the plant food with fertilizer, but you cannot buy organic matter. It is the organic matter that catches and holds the rain drops. In the course of decay, stubble returns to the soil some of the elements needed for crops that follow. Rob the soil of its organic matter and you reduce the water intake and water-holding capacity of your soil. If your soil is unable to absorb the rain as it falls there is run-off and water erosion. Lack of fibre in the soil paves the way for soil drifting."



Photo — Lethbridge Experimental Station

EXAMPLE OF WIND EROSION

*This picture shows how wind can damage sandy land.
The farm is in the Taber area.*

CHAPTER 8.

WATER EROSION

J. M. Fontaine, district agriculturist at Morinville, near Edmonton, said that one does not have to go to China or the United States to find signs of water erosion. Soil is washing away in almost every district in Alberta. People tramp over gullies and eroded land day after day and do not realize what is happening until the effects are pointed out to them.

Alberta Department of Agriculture — The rich soils of central and northern Alberta, as well as those of the south, are being ravaged by an enemy more subtle and more insidious than soil drifting — water erosion. Many of the fields in our best soil areas show minute rills or gullies in the spring after the snow has melted and after heavy rains. These rills, which grow into gullies and then into ravines, are the fingerprints of the monster Erosion.



Photo — Alta. Dept. of Agriculture

THE START OF TROUBLE

Water erosion to depth of plowing. If unchecked it will result in gully erosion.

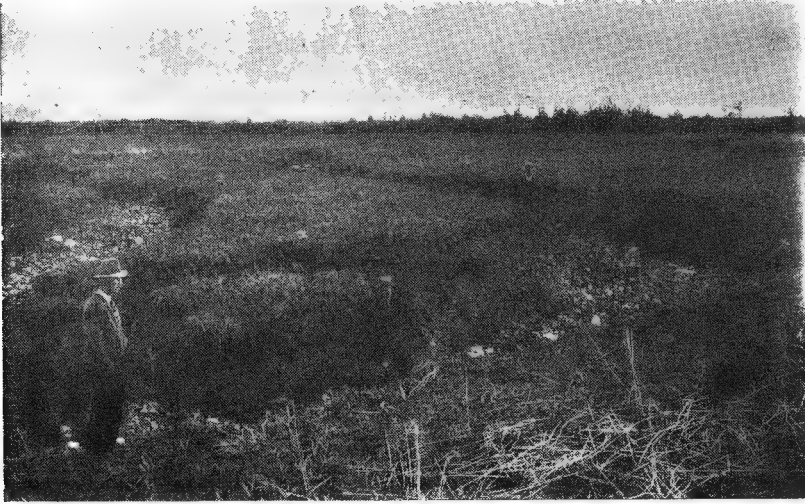


Photo by W. D. Albright

WATER RAVAGED LAND

Six-foot gully with tributaries, cut through what had been a nice smooth field of black soil at Halcourt, northwest of Edmonton.

Farmers are less conscious of the damage caused by water erosion than that caused by wind. Nevertheless water erosion is depleting many farms of irreplaceable fertile soil.

In the pamphlet "Cropping for Profit and Permanency" W. E. Bowser and A. G. McCalla say: "Every year, in every part of Alberta, heavy rains and spring run-off take a toll of fertile topsoil. Keeping up the fibre content reduces water erosion by increasing the water-holding capacity of the soil."

CHAPTER 9.

LIFE IN THE SOIL

Dr. H. G. Thornton, of the famous Rothamsted Experimental Station in England, developed a method of counting bacteria. He took a definite weight of soil, made a thin mud paste out of it, added a red dye that colors bacteria but does not affect other substances and soil, and then went to work with a powerful microscope. When his work was completed he had determined that average good soil may contain eight billion bacteria per teaspoonful. Among the most beneficial types of soil bacteria are those known as *B. rhizobium*, or legume bacteria. They attach themselves to the roots of alfalfa, clover, soybeans, peas and other legumes and aid these crops in obtaining and utilizing nitrogen from the air. Part of the nitrogen so secured is retained in the soil for succeeding crops. Another very active type is the cellulose decomposing bacteria which aids in the rotting of stubble straw and other crop refuse and manure.

Scientific research has produced some new wonder drugs from soil, including penicillin and the greatest healer of them all, streptomycin.

CHAPTER 10.

SHELTERBELTS PROVIDE PROTECTION

The planting of trees in shelterbelts not only prevents soil drifting but minimizes water evaporation.

At the Forest Nursery Station at Sutherland, Saskatchewan, 50 acres of oats were planted, 25 of which were on open prairie and the other 25 acres behind young hedges which were only two to three feet high. A big windstorm completely blew out the 25 acres in the open and the 25 acres behind the young hedges yielded 45 bushels to the acre.—(*Family Herald*, October 9, 1946.)

On the Craig Pierce farm at Drumheller in 1949 wheat grown close to a shelterbelt yielded 19 more bushels to the acre than wheat grown further off. On an 80 acre strip alongside a shelterbelt oats yielded 90 bushels to the acre. Further out, beyond the reach of the trees, the oats crop was poor and uneven and had to be cut for greenfeed.

The Dominion Government supplies seedling trees free of charge, except for freight, to farmers who desire to plant shelterbelts. Application should be made to the Forest Nursery Station, Indian Head, Saskatchewan.

The Alberta government is also encouraging tree plantings on Alberta farms. Information thereon is obtainable on writing to the Provincial Department of Agriculture, Edmonton, or from District Agriculturists.

CHAPTER 11.

WHO WILL BEAR THE COST?

While it should be the responsibility of governments to set up a conservation administration which would render service, give expert advice and conduct an educational program to encourage land conservation, the working out of such conservation programs is the responsibility of the individual.

It costs money, however, to carry out a conservation program and many farmers feel that they should not bear the whole of the expense. Seeding part of the farm to grass, for instance, will mean loss of revenue in that the same immediate cash returns will not be obtainable as if the land were sown to grain. Says one district agriculturist: "It is useless to suggest to the farmer certain recommendations which will bring about a reduction of income. The farmer simply will not listen to such recommendations. He is naturally anxious to increase his earnings."

Another land conservation authority says: "In the interests of conservation, the output of our oil wells and the cutting of our timber is being controlled without any bonuses. Is it any less logical to control farm production in the interests of conservation? If we have to depend on bonuses to save the soil it is doomed before we start."

In the United States the government pays approximately one-half of the cost of land conservation programs. In 1949-50 the amount expended by the government was around \$100 million. Co-operating farmers in the conservation program are paid for cover cropping, in some states for summer fallowing, and in other states for strip farming. In addition, farmers are paid for seeding grasses and legumes, contour tillage, terracing, and for the use of fertilizers, lime and green manure.

Clinton P. Anderson, former secretary of agriculture in the United States government said: "Experience has proven that neither an awareness on the part of the farmers of the need for conserving soil and water, nor the advice about needed conservation practices and how to carry them out, is enough to get the job done. Through the agricultural conservation program the government manifests the obligation of the people as a whole to share the responsibility as well as the benefits of assuring continued production of our soil."

Commentary

"There Should Be a Law"

L. B. Thomson, Director, Prairie Farm Rehabilitation Act: "There should be a law against farmers driving tractors faster than $3\frac{1}{2}$ miles an hour while tilling soil. This is one of the major factors contributing to pulverization of the soil."

Soil — A Bank Account

Dr. E. S. Archibald, chief of the Dominion Experimental Farm Service: "Soil is nothing but a bank account. If you draw out from a bank more than you deposit you get into trouble with your banker. If you draw more from the soil than you put back you get into trouble just as readily."

Loss of Organic Matter

J. W. Parker, Soils Specialist, Manitoba Agriculture Extension Service: "Manitoba farm land has been depleted of organic matter by about 50 per cent in the seventy odd years the province has been farmed. Organic matter provides the nutrient necessary to plant life, prevents erosion of soils and performs other necessary functions."

Democracy Depends on Conservation

Wilkie Collins Jr., agronomist, Lincoln, Nebraska: "The continuance of democracy in the United States might well depend on soil conservation. The wealth of a nation is not calculated on its gold dollar basis, but on its productive capacity. Agriculture is quite new in the United States and Canada and we don't even know if we can maintain a permanent system of agriculture."

Danger to Grey Wooded Soils

A. E. Wilson, Superintendent, Dominion Government Experimental Farm near Saskatoon: "The farmers in the park belt of Northern Saskatchewan are destroying fertility and losing top-soil by the same destructive methods used in southern areas. They are doing it at an alarming rate because the grey wooded soil of the park belt will not stand as much abuse as prairie soil."

The Rich Land of the West

Dr. R. K. Larmour, director, Prairie Regional Laboratory, Saskatoon, Saskatchewan: "The triangular prairie region between Winnipeg, Calgary and Edmonton, is the richest concentration of land to be found anywhere and is eyed by hungry, envious millions elsewhere. Land is the most fundamental natural resource. We are now within sight of the end of the total arable land resources in the world and yet the world's population is increasing one per cent per year. Land determines a nation's life or death because it produces food, and we have the lion's share but we do not realize until there is a war that we are the envy of the world."

Perpetual Program Needed

United States Soil Conservation pamphlet: "Erosion has severely damaged about 280 million acres of crop and grazing land in the United States. Another 775 million acres has eroded to some extent. We now have left about 460 million acres of good land that is suitable for crops . . . The needed conservation measures had been installed according to plan on about 11 per cent of our farm land or about 120 million acres, by the end of 1948 . . . We have made good progress since our national soil conservation program started in 1933 but we have made only a start. Most of the job still lies ahead. Even if we have a conservation plan for every farm and ranch we have taken only the first step towards saving our remaining land. The conservation farm plans must be carried out, not for years, but for all time."

ANGEL'S SOLILOQUY

Selected

*I did right well with my earth's bounty
Held fat notes on half the county
Made big crops and lots of dough.
Couldn't bring it with me, though.*

*Grandson, now, works twice as hard,
But gets low yields for his reward.
He'd make out better I've no doubt
Had I put in what I took out.*

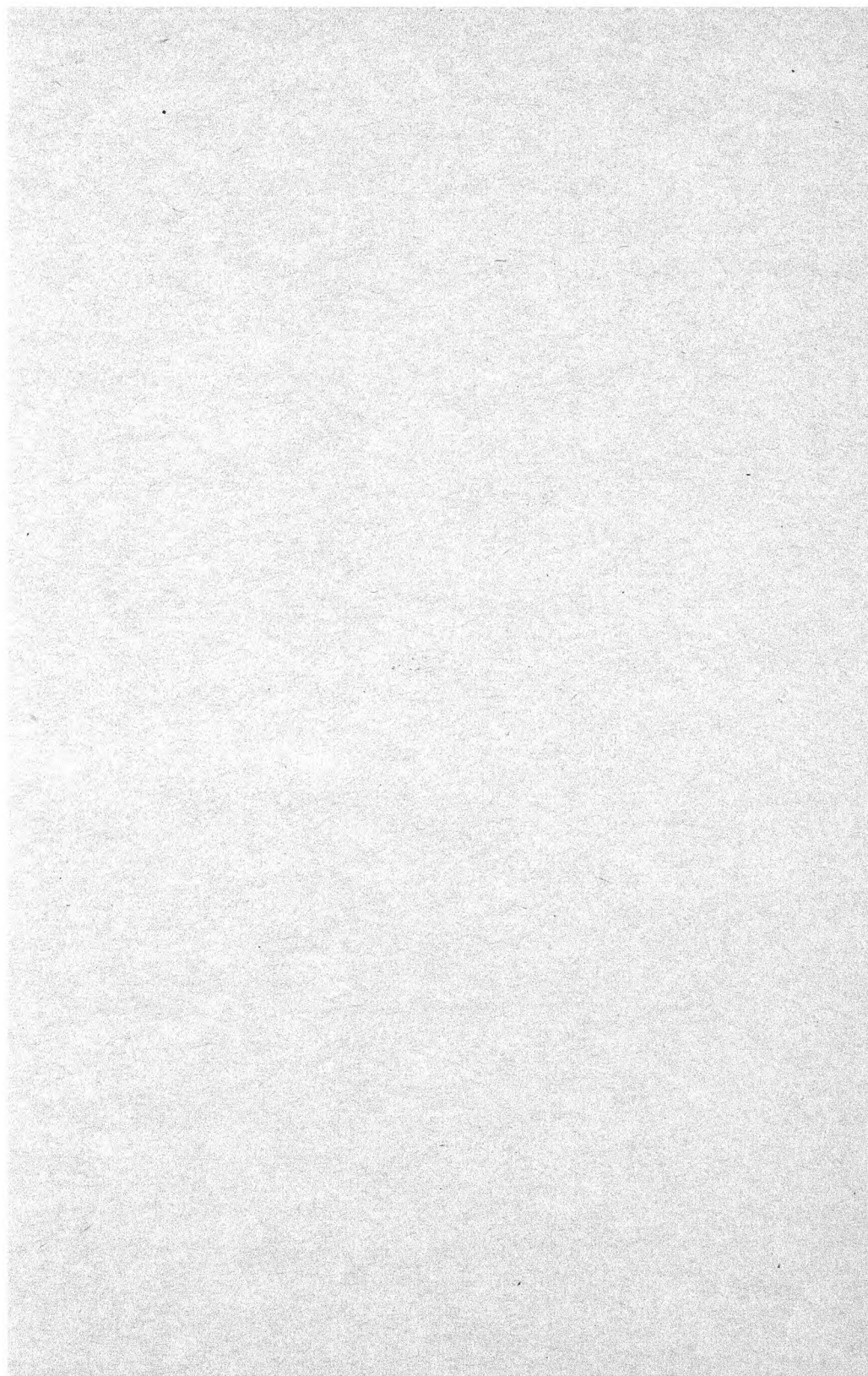


Most of the material in this booklet has been gleaned from writings and speeches of authorities on soil erosion. It is hoped that this publication will be of assistance in awakening interest and creating action in preventing land devastation.

The Alberta Wheat Pool is a co-operative association owned by 50,000 Alberta farmers. Its property includes 486 country elevators, a 5,000,000-bushel terminal at Vancouver, B.C., and a 2,000,000-bushel terminal at Port Arthur, Ontario.

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